REMARKS

Reconsideration of the application is requested in view of the above amendments and the following remarks. Claims 1-5 have been cancelled without prejudice or disclaimer. New claims 6-12 have been added and substantially track the limitations of cancelled claims 1-5. No new matter has been added.

The specification has been amended to include headings as suggested by the Examiner. Both a clean and marked up version of the specification showing the addition of the headings is enclosed.

Claim 5 was objected to for several formal matters. Claim 5 has been cancelled without prejudice or disclaimer, rendering this rejection moot.

Claim 5 was objected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claim 5 has been cancelled without prejudice or disclaimer, rendering this rejection moot.

Claims 1 and 2 were rejected under 35 U.S.C. § 103(a) as being unpatentable over GB 2 182 603 ("GB 603") in view of Carlsen, U.S. 4,140,460. Applicant respectfully traverses this rejection. Claims 1 and 2 have been cancelled, rendering this rejection moot. However, Applicant addresses this rejection insofar as it relates to new claims 6 and 7.

GB 603 discloses the use of air being passed through a passage 4 in the mandril so as to provide within the tube after extrusion and internal air pressure P. To maintain the air pressure, the tube end may be crimped over or an internal plug may be provided within the tube connected to the mandril. After leaving the mandril and dye, the still soft pipe expands in a "bubble" due to the pressure difference across its sidewall (see page 1, lines 111-126). Carlsen discloses a conventional blow film dye from which a tube 11 of plastic material having a diameter D_1 is extruded. Due to the gas pressure in the interior of the tube, the tube expands in diameter, or "blows", to a larger diameter D_2 (see column 2, lines 32-40).

The diameter sensors 21 disclosed by Carlsen produce signals related to the blown tube diameter that are used to operate the damper positioning motor 20. After start up of the process, the dampers 16 and 17 are manually adjusted until the desired tube diameter D_2 is obtained. The dampers 16 and 17 are left in their respective position and further adjustment of the flow is made automatically by movement of the bypass damper 19 through actuation by the positioning motor 20 responsive to the signals from the sensors 21. Thus, Carlson discloses adjustment of the

internal pressure of the extruded "bubble" in response to tube diameter measurements from sensors 21.

The combination of Carlsen and GB 603 fails to disclose or suggest every limitation of claim 6. The combination of GB 603 and Carlsen is limited to the adjusting an outer diameter of an extruded "blown" tube by controlling the flow of air within the blown tube. In contrast, the claimed invention requires that "the outer surface of the melt column is exposed to the vacuum in the vacuum chamber, and a change in the vacuum changes the outside diameter of the melt column in a controlled manner based on a measured outside diameter of the melt column determined by the measuring tools." Neither GB 603, Carlsen, nor a combination of these references disclose changing the vacuum in a vacuum chamber to change the outside diameter of a melt column based on the measured outside diameter of the melt column determined by the measuring tools. Therefore, Applicant submits that even if the GB 603 and Carlsen references are combined, their disclosure fails to disclose or suggest every limitation of claim 6, and the claims that depend from it. Withdrawal of the rejection is respectfully requested.

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over GB 2 182 603 in view of Carlsen, U.S. 4,140,460, and further in view of Sweeney et al., U.S. 4,355,966. Applicant respectfully traverses this rejection. Claims 3 and 4 have been cancelled, rendering this rejection moot. However, new claims 8 and 9 substantially track the limitations of cancelled claims 3 and 4. Therefore, Applicant addresses this rejection insofar as it applies to new claims 8 and 9.

As discussed above, GB 603 and Carlsen fail to disclose or suggest every limitation of claim 6. Sweeney fails to remedy the deficiencies of GB 603 and Carlsen as they relate to claim 6. Therefore, Applicant submits that claims 8 and 9 are allowable for at least the reason they are dependent upon an allowable base claim.

Claim 5 was provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 6 of copending application Serial No. 09/787,981. Claim 5 has been cancelled, rendering this rejection moot. However, new claim 10 includes some of the limitations of cancelled claim 5. Therefore, Applicant addresses this rejection insofar as it relates to new claim 10.

Claim 6 of copending application Serial No. 09/787,981 has been cancelled in an Amendment and Response mailed to the Patent Office on May 5, 2003. Therefore, there is no longer a basis for this rejection. Withdrawal of the rejection is respectfully requested.

In view of the above, Applicant requests reconsideration of the application in the form of a Notice of Allowance. If a phone conference would be helpful in resolving any issues related to this matter, please contact Applicant's attorney below at 612.371.5265.

Respectfully submitted,

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DEVICE FOR PRODUCING PLASTIC PIPES

Background of the Invention

The invention relates to a device for producing plastic pipes according to the precharacterizing clause of the main claim.

In equipment that produces plastic pipes, there exists the problem that pipes of different outside diameters must be produced with, at the same time, different wall thicknesses. In the prior art in this regard it is necessary that, corresponding to the outside diameter of the pipe and to the desired wall thickness (usually normalized in dependence on the outside diameter) of the pipe, appropriate tools be interchanged. This causes a stopping of the machine, a high labor expense for the exchanging of the tools, and a loss of plastic material, until the new pipe can be again drawn. An appropriate drawing of the pipe that allows the production of a pipe of less wall thickness, with an existing outside diameter, is for this reason impossible, since the molecular chain of the plastic material is stretched and also orientated in such a manner that thereby the strength of the pipe is negatively influenced, and the formation of shrinkings and foldings is fostered.

Described in AT 401 031 B is a device for regulating the wall strength of a pipe consisting of thermoplastic plastic masses and produced through extrusion. In this arrangement, the extruded pipe is placed into a calibrating mold against the latter's cooled inside wall by means of an underpressure generated in the region of the inside wall. In this, the inside wall of the calibrating mold is subdivided into sections or sectors adjoining one another in the circumferential direction, which sections or sectors are thermally uncoupled from one another, with independently controllable temperature equipment assigned to the individual sectors or sections. If pipe of different outside diameters are to be produced, then the inner equipment of the calibrating chamber, against which the outside pipe wall is placed through underpressure, must be completely changed out and replaced by other equipment having a different diameter.

Also, explained in DE 19 23 490 A1 is a calibrating chamber in which are arranged baffles that are independent of each other, which baffles are cooled, generating in the calibrating chamber an underpressure through which the pipe outside wall is placed against the baffles. Here likewise, when different pipe outside diameters are required, a re-equipping of the calibrating chamber through the use of different baffles is necessary.

The baffles are not adjustable in their baffle-opening width, but rather only in their distance between one another.

Known from GB-A-21 82 603 is the use of a vacuum-tight chamber with a vacuum connection as a vacuum suction bell. Through the widening of the extrusion emerging from the drawing tool, transversely to the longitudinal axis of the pipe, a better fiber reinforcement of the product in the circumferential direction should be achieved.

Summary of the Invention

In contrast to this, the object of the invention is to create a device in order to achieve during the production phase of the pipe, without interruption of the production process, a fully automatically-controlled conversion between several plastic pipe dimensions in the continuous extrusion process, the outside diameter and the pipe wall thickness being adjusted according to customer desires or to standardization, as the case may be.

This object of the invention is attained through the teaching of the main claim.

Advantageous configurations are explained in the dependent claims.

Expressed in different terms, it is proposed that a vacuum suction bell be connected to the pipe head in the direction of production, which vacuum suction bell is formed by a vacuum-tight chamber, to which is joined a vacuum connection; inside the chamber, measurement instruments control the outside diameter of the present molten extrusion and appropriately control the vacuum. Thus, through these means, the molten extrusion can be, for example, sucked up to a larger outside diameter, in order to be then conducted into the devices serving the further processing of the molten extrusion.

Subsequently, the mass extrusion reaches a calibrating station, in which different pipe dimensions can be set. To be sure, known from WO 96/36 457 is the method of carrying out minor calibration adjustments in a calibrating station by the fact that through a wedging effect, individual open calibrating rings can be slightly changed in their diameter. With such an arrangement, however, a variation of the pipe outside dimension is not achievable, but rather it is merely counteracted by the contraction behavior. Subsequently to the calibrating station, the plastic pipe, not yet completely hardened, then enters a vacuum calibrating bath, the support rollers of which are adjustable to the desired pipe outside diameter. In this vacuum calibrating bath, the pipe is cooled, and thus solidified, through the addition of water and leaves this vacuum calibrating bath through a vacuum seal, which for its part is designed to automatically adjust to the pipe outside diameter, e.g. through a spring arrangement or through hydraulic adjustments; here also, water can be added for lubrication and sealing.

The whole production line can be automatically controlled through settings controlled, for exampl , by the size of th pipe widened in the vacuum suction bell; that is to say, through the prescription of a setting, for example inside the vacuum suction bell, all of the other calibrating-support and –sealing equipment fitting the outside diameter of the pipe is also set.

However, with the production line according to the invention, also in normal pipe production the actual value of the cooled-down pipe can be controlled and in the case of deviations can be readjusted.

Brief Description of the Drawings

In the following, an example embodiment of the invention will be explained with the aid of the drawings. They show:

Fig. 1: an overall view of a production device

Fig. 2: on a larger scale, the actual suction bell

Detailed Description of the Drawings

Recognizable in Fig.1 is an adjustable pipe head, which, seen in the production direction, adjoins an extruder (not represented in the drawing). Connected to the adjustable pipe head 1 is a vacuum suction bell 2, which is equipped with a vacuum suction connection 5, in which provision is made for measuring devices that, depending on the desired pipe outside diameter, set the vacuum prevailing in the suction lock, so that thereby the pipe-shaped stream of molten material is adjusted to the desired outside diameter, i.e. is sucked up; in this, a pre-cooling of the molten extrusion can already take place in the vacuum suction bell 2. In the vacuum suction bell 2, in conjunction with the adjustable pipe head an exact pipe wall thickness can be set; the pipe wall thickness can be varied depending on the outside diameter of the pipe.

Connected to the vacuum suction bell 2 is a calibrating station 3. Here, through a mechanical central adjustment, takes place the exact calibration of the outside diameter of the extrusion of molten material and of the already partially-hardened pipe, this calibration being applicable to all plastics that come into consideration. In this calibration station, several dimensions can be adjusted even with the different wall thicknesses.

In a vacuum calibrating bath 4 connected with this, seen in the production direction, the cooling down and hardening of the plastic pipe then takes place through water spray, a water feed 6 and a water outlet 7 being recognizable in the drawing. Further, joined to the vacuum calibrating bath 4 is a vacuum connection 8, and the pipe 10 located in the vacuum calibrating bath 4 passes over support rollers 11,

which can als be called the calibrating rollers and can be set to the desired pipe diameter. The surface of the pipe 10 is relatively hard, and the pipe 10 leaves the vacuum calibrating bath 4 through a vacuum seal 9, which either adjusts automatically to the pipe diameter or is adjusted depending on the pipe dimensions set in the calibrating station 3 and/or in the vacuum calibrating bath 4. In the vacuum seal 9 can be arranged formed rollers, which are actuated hydraulically or through mechanical springs; here, at the same time, water for lubrication and sealing can be introduced into the path of the pipe.

The suction bell represented in Fig. 2 consists in essence of a vacuum-tight chamber 30, into which leads the pipe-shaped molten extrusion 10. This chamber is equipped with a vacuum connection 5, and provision is made inside the chamber for measuring instruments (not represented in the drawing), which control the outside diameter of the molten extrusion and, depending on the desired widening of the molten extrusion, now control the vacuum, so that this is higher or lower. Thus, there takes place a regulating of the vacuum in dependence on the desired pipe geometry, i.e. of the desired pipe outside diameter.

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